6.0 OTHER PUBLIC HEALTH ISSUES

The purpose of this section is to investigate the possible relationship between indicator organism (FC) levels and other public health issues, particularly known pathogenic microorganisms in Galveston Bay. Among the pathogens, Vibrios are of primary concern because of their medical significance and their ability to be transmitted through various contact and noncontact recreational activities and the consumption of seafood. This transmission ability affects shellfish harvesting and shipping which are currently regulated based on FC levels. Thus, a major objective of this investigation is to assess the appropriateness of using FC for predicting possible Vibrio infections.

The first part of this section is a description of Vibrio bacteria which are of major concern. Next, data obtained from TDH concerning the incidents of Vibrio infections in Texas were analyzed and reported. The relationship between these incidents and FC data was then explored and documented. A brief investigation was also performed to determine the existence of data about other known diseases reported which are associated with shellfish and other seafood consumption. The last part of this section is a conclusion of this investigation.

6.1 THE VIBRIO ORGANISM, ITS REQUIREMENTS, RELATION TO ANTHROPOGENIC SOURCES AND CHARACTERISTICS

Vibrios are members of the genus Vibrio containing Gram-negative, rod-shaped bacteria which utilize glucose fermentatively and are widespread in many natural aquatic environments. The genus Vibrio contains eleven species which are pathogenic for humans. Those of prime medical concern are V. cholerae, V. parahaemolyticus and V. vulnificus. Other organisms implicated as opportunistic pathogens are V. alginolyticus, V. damsela, V. fluvialis, V. furnissii, V. hollisae, V. mimicus, V. metschnikovii and V. cincinnatiensis (Morris and Black, 1985; Brayton et al. 1986). A few species are economically important pathogens of fish and shellfish. For the purpose of this investigation, the focus is on the relationships between Vibrios and water temperature, salinity, shellfish, etc. and the mechanisms of infection.

6.1.1 Influence of Environmental Conditions on Survival of Pathogenic Vibrios

Human pathogenic Vibrios are naturally-occurring in aquatic environments of areas apparently free from endemic disease. The microbial ecology of these pathogens becomes important because this significantly dictates the occurrence and epidemiology of human infections (West, 1989). The significant environmental conditions which influence the survival of pathogenic Vibrios include water temperature, sediment conditions, salinity, nutrient concentration, association with higher marine and land organisms, and animal and birdlife reservoirs.

Water temperature appears to be the single most important factor governing the incidence and density of pathogenic Vibrios in natural aquatic environments. Pathogenic vibrios are found more frequently in environments whose water temperature exceeds 10°C (50°F) for at least several consecutive weeks (Bockemuhl et al. 1986; Rhode, Smith, and Ogg, 1986; Chan et al. 1989). In some regions this threshold temperature may be higher. Most pathogenic Vibrios rapidly disappear from the water column at temperatures below 10°C but can persist in sediments. Under more favorable environmental conditions Vibrios can proliferate and reemerge in the water (Williams & La Rock, 1985). At the other extreme, pathogenic Vibrios are less frequently isolated from natural aquatic environments when water temperatures exceed 30°C (86°F) (Seidler and Evans, 1984; Williams & La Rock, 1985). It would appear that from a temperature limitation standpoint Galveston Bay is ideally suited to Vibrio survival in that the water temperature in Galveston Bay is rarely less than 10°C or greater than 30°C.

Pathogenic Vibrio species have halophilic characteristics and occur most frequently in water ranging in salinity from 5 to 30 ppt, significantly limiting their presence to estuarine and inshore coastal areas (Lee and West, 1982; Seidler and Evans, 1984; Bockemuhl et al. 1986; Kelly and Dan Stroh, 1988). Pathogenic Vibrios may be isolated from some freshwaters with less than 5 ppt salinity where it is possible that the interaction of high water temperature and elevated organic nutrient concentration overcomes the deleterious effect of low salinity. Also, the prolonged survival of the organism was possible in high nutrient but low salinity environments (West, 1989).

Most pathogenic Vibrios appear to maintain high numbers and prolong their existence by association with a variety of higher organisms in the aquatic environment including plankton, shellfish and fish. In particular the chitin component in plankton appears to enhance significantly this phenomenon of prolonged survival (Huq et al. 1985, 1986). It is likely that, at some stage, all pathogenic Vibrios become associated with chitinous parts of planktonic material to both increase numbers of cells in the aquatic environment and to prolong survival in unfavorable conditions (West, 1989).

Bivalve molluscan shellfish (oysters and clams) may become rapidly contaminated when filter-feeding on planktonic material colonized by pathogenic Vibrios and so are often subsequently incriminated as vectors in food-poisoning incidents (Kelly and Dinuzzo, 1985). Association with the flesh of oysters and clams after harvesting prolongs the survival of pathogenic Vibrios outside aquatic environments. Storage of contaminated shellfish at inappropriate temperatures can then lead to rapid proliferation of pathogenic Vibrios (Karunasagar, Karunasagar, Venugopal and Nagesha, 1987). Marked seasonal variations of pathogenic Vibrios in filter-feeder flesh are often seen since the frequency of contamination is influenced by the numbers of bacteria in the surrounding water column (Kelly and Dan Stroh, 1988; Chan et al. 1989).

Crustacean shellfish can also become colonized with pathogenic Vibrios. This appears to be dependent on high counts of bacteria in the surrounding water so that it is more commonly observed in warmer climates (Davis and Sizemore, 1982; Huq et al. 1986). Fish from inshore coastal waters and estuaries can be expected to be colonized with low numbers of pathogenic Vibrios (West, 1989).

There is no clear evidence that land animals act as a significant reservoir for V. cholerae 01 in countries endemic for cholera (Miller, Feacham, and Drasae, 1985). However, non-01 serotypes of V. cholerae have been isolated from domestic animals, waterfowl and a variety of wildlife in nearshore habitats of non-endemic cholera regions (De Paola, 1981). The role of land animals in maintaining this pathogenic Vibrio in the aquatic environment, and transmitting disease remains unclear (West, 1989). Evidence has been accumulated to suggest that aquatic birds serve as carriers to disseminate V. cholerae over wide areas not endemic for cholera (Lee et al. 1982; Ogg, Ryder, and Smith, 1989). Interestingly, no other pathogenic Vibrio species appear to be harbored by aquatic birdlife (West, 1989).

6.1.2 Mechanisms of Infection by Vibrios

Since pathogenic Vibrio species occur naturally in aquatic environments, control of sewage contamination will have little or no effect in preventing the spread of infection. An exception is the cholera infection in endemic areas where secondary infections follow contamination of unprotected drinking water supplies or food. Risks of infection with pathogenic Vibrio species are most strongly associated with (i) impaired host resistance factors in susceptible hosts; (ii) occupational or recreational use of natural aquatic environments; and (iii) consumption of contaminated foods, especially seafood (West, 1989).

There is convincing epidemiological evidence that consumption of certain foods, especially raw or lightly cooked seafood and shellfish, is associated with outbreaks of diseases due to pathogenic Vibrio species. In particular, infections due to V. cholerae, V. parahaemolyticus and V. vulnificus have been associated with eating raw bivalve shellfish (Salmaso et al. 1980; Tacket, Brenner, and Blake, 1984).

Counts of free-living bacteria in water are generally less than required to induce disease. Increases in number of organisms towards an effective dose can occur as water temperatures rise seasonally followed by growth and concentration of bacteria on higher animals, such as chitinous plankton, or accumulation by shellfish and seafood.

Pathogenic Vibrio species must elaborate a series of virulence factors to elicit disease in humans. The relations among pathogenic Vibrio species and human infections can be summarized as listed in Table 6-1 (West, 1989).

TABLE 6-1
PATHOGENIC VIBRIO SPECIES ASSOCIATED WITH VARIOUS HUMAN INFECTIONS
(AFTER WEST, 1989)

SPECIES	GASTRO-INTESTINAL TRACT	WOUND	EAR	PRIMARY SEPTICAEMIA (a)
V. cholerae 01	M	R	U	U
V. cholerae non-01	M	O	O	R
V. parahaemolyticus	M	O	R	U
V. vulnificus	O	M	U	M
V. fluvialis	M	U	U	U
V. alginolyticus	U	M	O	U
V. damsela	U	M	U	U
V. furnissii	R	U	U	U
V. hollisae	M	U	U	R
V. mimicus	M	O	O	U
V. metschnikovii	R	U	U	R
V. cincinnatiensis	U	U	U	U

SPECIES	BACTEREMIA (b)	LUNG	MENINGES (c)
V. cholerae 01	U	U	U
V. cholerae non-01	R	U	R
V. parahaemolyticus	R	R	R
V. vulnificus	O	R	R
V. fluvialis	U	U	U
V. alginolyticus	R	U	U
V. damsela	U	U	U
V. furnissii	U	U	U
V. hollisae	U	U	U
V. mimicus	U	U	U
V. metschnikovii	U	U	U
V. cincinnatiensis	R	U	R

M = most common site of infection R = rare sites of infection
O = other sites of infection U = infection remains to be firmly established
(a) invasion of bloodstream by virulent microorganisms from a local seat of infection accompanied especially by chills, fever, and prostration
(b) the usual transient presence of bacteria or other microorganisms in the blood
(c) infections and swelling of any of the three membranes that envelop the brain and spinal cord

As can be seen in Table 6-1, Vibrio infections can be transmitted through various human activities. The most common infection type is gastrointestinal, presumably associated with consumption of seafood or some types of contact recreations which may cause the victims to ingest contaminated water. Blood or wound infections are presumably associated with noncontact recreational activities. V. vulnificus appears to be most active by this route. As reported in the following sections, the Vibrio data obtained from TDH support these findings on the mechanisms of Vibrio transmissions.

6.2 VIBRIO OCCURRENCE, INCIDENTS OF ILLNESS & FATALITIES, AND MECHANISMS OF INFECTION

After communicating with Ms. Bevely Ray of the TDH, Epidemiology Division, data on the outbreaks of Vibrio diseases were obtained (Ray, 1991). These data, include information such as the patient's age, sex, race, county of residence, Vibrio organism, onset date, outcome of infection, number of underlying medical conditions, exposure (foods, water, etc.), site (location where the patient was infected), and activity (suspected activity which caused the infection). There were a total of 176 Vibrio infection cases reported for the entire State of Texas between May of 1981 and September of 1991. Before 1986 there was no requirement for reporting so infections between 1981 and 1986 were probably under-reported (Ray, 1992).

Because the TDH site data are only approximate, analysis based upon the TWC segments cannot be performed. A first analysis of the data was performed by sorting the data into the counties surrounding the Galveston Bay. The results, listed in Tables 6-2, show that for the Brazoria, Chambers, Galveston, Harris, and Liberty Counties, there are 7, 0, 12, 46, and 3 Vibrio incidents respectively. Except for Harris County where most infections are due to consumption of (sea) foods, most infection are due to contact and noncontact recreation. The rates of infection per capita in the smaller population counties (except Chambers) probably reflect a higher participation rate in bay recreational activities.

Even though an incident of Vibrio infection may be reported in a county near Galveston Bay, the patient may not have been infected in the bay area. This is especially true for those cases in which the infections were due to the consumption of oysters in restaurants where the source is unknown.

However, as listed in Table 6-3, there are 12 cases in which the site of infection was specified to be the Galveston Bay area. Among these 12 cases, one patient died of the disease. The mechanisms of infections for these cases include various kinds of contact and non-contact recreational activities. Five cases out of 12 are due to contact recreation.

Table 6-4 lists the statistics of these 12 incidents of Vibrio infections due to activities in the bay area. Among these statistics, the onset month data indicates seasonal variations

TABLE 6–2
OUTBREAKS OF VIBRIO DISEASES IN COUNTIES AROUND GALVESTON BAY

MECHANISM OF INFECTION	COUNTY					TOTAL
	BRAZORIA	CHAMBERS	GALVESTON	HARRIS	LIBERTY	
RECREATION	4	0	7	13	2	26
% TOTAL RECREATION	15.38	0.00	26.92	50.00	7.69	100
Rate (* E5)**	2.09	0.00	3.22	0.46	6.11	0.79
FOOD CONSUMPTION	1	0	4	20	0	25
UNKNOWN	2	0	1	13	1	17
% TOTAL FOOD & UNKNOWN	7.14	0.00	11.90	78.57	2.38	100
Rate (* E5)**	1.56	0.00	2.30	1.17	3.06	1.28
TOTAL INCIDENTS	7	0	12	46	3	68
% TOTAL INCIDENTS	10.29	0.00	17.65	67.65	4.41	100
Rate (* E5)**	3.65	0.00	5.52	1.63	9.17	2.07
POPULATION*	191,707	20,088	217,399	2,818,199	32,726	3,280,119
% TOTAL POPULATION	5.84	0.61	6.63	85.92	1.00	100

* Source: Bureau of the Census (1990)

** Data represent number of Vibrio incidents per capita per 10 years of record period

TABLE 6-3
OUTBREAKS OF VIBRIO DISEASES ASSOCIATED WITH ACTIVITIES IN GALVESTON BAY

AGE	SEX	COUNTY	ORGANISM	MON-YEAR	OUTCOME*	EXPOSURE	SITE	ACTIVITY
32	F	Galveston	Vulnificus	Sep-83	R	seawater	Galveston Bay	sex
54	M	Harris	Parahaemolyticus	Jun-86	R	sustained wound	Galveston Bay	stepped on sharp object in water
57	M	Harris	Cholerae non01	Jul-87	D	sustained wound	Galveston Bay	bitten by crab
31	F	Wharton	Parahaemolyticus	Sep-87	R	sustained wound	Galveston Bay	walking
72	M	Harris	Vulnificus	Oct-87	R	water	Galveston Bay	fishing
34	M	Brazoria	Cholerae non01	Aug-89	R	sustained wound	Galveston Bay	wade fishing
28	M	Harris	Vulnificus	Apr-90	R	sustained wound	Galveston Bay	windsurfing
4	F	Henderson	Vulnificus	Jul-90	R	water	Galveston Bay	swimming
67	M	Harris	Vulnificus	Aug-90	R	sustained wound	Galveston Bay	fishing
46	M	Harris	Parahaemolyticus	Sep-90	R	sustained wound	Galveston Bay	swimming
78	M	Galveston	Parahaemolyticus	May-91	R	sustained wound	Galveston Bay	fishing
11	M	Galveston	Vulnificus	Aug-91	R	water	Texas City	playing in water

* D -died, R - recovered

TABLE 6-4

STATISTICS OF INCIDENTS OF VIBRIO DISEASES IN GALVESTON BAY

ONSET MONTH	NO. OF INCIDENTS
JAN	0
FEB	0
MAR	0
APR	1
MAY	1
JUN	1
JUL	2
AUG	3
SEP	3
OCT	1
NOV	0
DEC	0

ONSET YEAR	NO. OF INCIDENTS
1983	1
1984	0
1985	0
1986	1
1987	3
1988	0
1989	1
1990	4
1991	2

COUNTY	NO. OF INCIDENTS
BRAZORIA	1
GALVESTON	3
HARRIS	6
HENDERSON	1
WHARTON	1

ORGANISMS	NO. OF INCIDENTS
Cholerae non-01	2
Parahaemolyticus	4
Vulnificus	6

ACTIVITY	NO. OF INCIDENTS
Contact Recreation	5
Noncontact Recreation	7

in the occurrences of Vibrio infections, with summer predominating. This is consistent with the characteristics of Vibrio species described in Section 6.1 about the relationship between water temperature and Vibrios. As for the frequency of the occurrence, there is one case in 1983, 1986, and 1989, two cases in 1991 up to November, three cases in 1987, and four cases in 1990. These data for annual statistics are fairly random suggesting no obvious temporal trend. The relationship between the number of Vibrio incidents and the species indicates that the V. vulnificus may be more significant than V. cholerae. Looking at the population data (Table 6-2), Galveston County has a relatively high proportion of recreation-related incidents. Galveston County has 6.6 % of the population but had 26.9% of the recreation related incidents. The infection mechanisms of food consumption and unknown source appears to track with the population data reasonably well.

To determine the relative importance of contracting Vibrio infections through contact and noncontact recreation and through the consumption of seafood, an analysis was performed by comparing the data associated with Harris and Dallas Counties. These two counties were selected because both are highly populated areas but one is close to the coast and the other is not. The objective is to explore what effects proximity to the coast has on Vibrio outbreaks. This comparison is shown in Table 6-5.

As can be seen in Table 6-5, the rates of Vibrio infections per capita for Harris County are higher than those for Dallas County except for unknown ways of infections. For those incidents associated with contact and noncontact recreations, the rate is about nine times higher in Harris than in Dallas County. Realizing that people in Dallas have less opportunity for recreational activities in salt water, these data suggest that salinity is indeed a key factor in the survival of Vibrios. Also, if it is true that people in Harris County consume more fresh seafood than people in Dallas County, then the data listed in Table 6-5 suggest that the consumption of seafood is one of the major mechanisms for the transmission of Vibrio diseases.

6.3 RELATIONSHIP BETWEEN VIBRIO OCCURRENCE & CORRESPONDING FECAL COLIFORM RECORDS

Among the 12 cases of Vibrio infections which occurred in Galveston Bay area, 5 cases were due to contact recreational activities with the remaining 7 due to noncontact recreation. According to the Texas Surface Water Quality Standards, the FC level can not exceed 200, 2,000, and 14 colonies/dL for contact recreation, noncontact recreation, and shellfish harvesting areas respectively. The objective of this section is to determine the relationship, if any, between the occurrences of Vibrio infections and the FC levels.

Because the Vibrio data obtained from TDH are not listed by segment, there is no reasonable way to relate them with FC data in any single segment. Instead, as listed in

TABLE 6–5
INCIDENTS OF VIBRIO DISEASES IN HARRIS AND DALLAS COUNTIES

County	HARRIS	DALLAS
No of incidents	46	14
Population*	2,818,199	1,832,810
Infected by C/NC recreation	13	1
Rate (* E6)**	4.6	0.5
Infected by food consumption	20	3
Rate (* E6)**	7.1	1.6
Infected by unknown ways	13	10
Rate (* E6)**	4.6	5.5

* Source of population data: Bureau of the Census (1990)
** Data represent number of Vibrio incidents per capita per 10 years of record period

Table 6-6, FC data associated with Galveston Bay segments are averaged. The only exception is the Vibrio case which occurred at Texas City, presumably segments 2437 or 2439. For this case, the relationship between the fecal and Vibrio data is determined by FC data in Segments 2437 and 2439 only.

Table 6-6 lists the mean FC data corresponding to the months when the cases of Vibrio infections were reported. The monthly values are geometric means over all stations in the segments. For data below the detection limits, the limits themselves were used to do the averaging. One obvious result can be seen from Table 6-6 that none of the geometric mean FC values exceeds the water quality criterion for contact recreation, 200 colonies/dL. In fact, except for the case in July of 1990, none of the mean FC levels in all segments in Galveston Bay exceeds the 200 criterion although there are Vibrio incidents. This result tends to suggest that FC indicator provides little information on the possibility of Vibrio infection.

For the two cases in May and August of 1991 listed in Table 6-6, there are no FC data for comparison. This is because they were not available at the time the data were obtained from TWC. Hence, they are compared with the historical data listed in Table 6-7. These historical FC data are computed by geometrically averaging all records at a station and then all stations in a segment. Finally, an overall mean value for all segments is obtained, which is 24.5 colonies/dL, far below the 200 colonies/dL criterion. The mean FC data for segments 2437 and 2439, near Texas City where Vibrio infection was reported, are 19.2 and 34.9 respectively.

The above comparison suggests that having water with FC levels below the contact recreation criteria provides no assurance that a Vibrio disease will not be contracted. This is consistent with the investigation performed in Apalachicola Bay, Florida (Rodrick, et al., 1984). Rodrick et al. measured both the FC and the Vibrio levels and discovered that there is little relationship between the presence of Vibrio parahaemolyticus, V. cholerae, V. alginolyticus, and V. vulnificus and the standard FC MPN value for seawater and oyster meats. In addition, when seawater FC levels were acceptable ($\leq$ 14 MPN), only 58% of the oysters sampled met the acceptable tissue FC levels. In summary, Rodrick et al. concluded that both seawater and oysters can serve as a vehicle for the transmission of Vibrio infections even when considered safe by existing federal and state standards. They further pointed out that such water quality standards may be ineffective in predicting the presence of certain potentially pathogenic Vibrios which are not of human fecal origin.

Another investigation on this relationship was performed locally. In order to assess the public health significance of elevated FC levels presumably originating from non-human sources, a study was performed in the Cow Trap Lake, a shellfish growing area in Texas, by TDH, U. S. Food and Drug Administration, and U. S. Fish and Wildlife Service in 1989 (TDH et.al, 1990). The Cow Trap Lake area was selected for the study because it

TABLE 6–6
RELATIONSHIP BETWEEN VIBRIO OUTBREAKS AND LEVELS OF FECAL COLIFORM

Vibrio Infections			Fecal Coliform Level (colonies/100 mL) for Segment*																				Remark**
County	Mo/Yr	Site	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	AVG	
Galveston	9 83	Galveston Bay									170	10										41	NC
Harris	6 86	Galveston Bay	13			63								10	10	10	10				26	16	NC
Harris	7 87	Galveston Bay	10			10				70										10	10	15	NC
Wharton	9 87	Galveston Bay					8															8	NC
Harris	10 87	Galveston Bay	5			10				10										5	5	7	NC
Brazoria	8 89	Galveston Bay	8	11						150			36						30		11	23	C
Harris	4 90	Galveston Bay	61		8			40	50												8	24	C
Henderson	7 90	Galveston Bay	9		9			700	1,000		13,000	4,100						1,300		9	9	190	C
Harris	8 90	Galveston Bay	16	6						10			20						10		18	12	NC
Harris	9 90	Galveston Bay				10								10	10						10	10	C
Galveston	5 91	Galveston Bay																				***	NC
Galveston	8 91	Texas City																				***	C

* Values listed are geometrically average values of all stations in corresponding segments
** NC = noncontact recreation; C = contact recreation: categorized by activities which caused Vibrio infections
*** Data not available from TWC at date this analysis was performed

TABLE 6-7
LONG-TERM MEAN FECAL COLIFORM LEVELS FOR SEGMENTS IN GALVESTON BAY

Segment	Mean Fecal Coliform Level for a Station (colonies/100 mL)							Mean*
2421	12.0	32.2	11.9	11.1	14.8	22.4		16.0
2422	17.8	11.8	15.1	21.4	11.2			15.0
2423	13.8							13.8
2424	10.8	10.8	18.3	8.8	9.5	9.2		10.9
2425	98.5	59.6	54.7	56.4				65.2
2426	34.6	16.7	200.0					48.7
2427	34.3							34.3
2428	37.2	62.2						48.1
2429	65.8							65.8
2430	200.0	55.0						104.8
2431	16.5							16.5
2432	13.0	50.0						25.5
2433	10.7							10.7
2434	9.5	12.9						11.0
2435	11.0							11.0
2436	34.2							34.2
2437	12.1	13.8	19.0					14.7
2438	19.2							19.2
2439	9.8	10.6	9.2	15.6	2,629.3	87.9	18.5	34.9
Mean Over All Segments*								24.5

* All mean values are taken geometrically and are computed based on TWC data only

was an area that had exhibited elevated FC levels that originated from non-human sources. The study was performed to determine the sources of elevated FC in the area and the densities of a selected group of microbial indicators and pathogens such as Cryptosporidium, Vibrio cholerae 01, Campylobacter, etc. During the study, water samples collected were analyzed for ten indicators and eight pathogens. Oysters were analyzed for additional indicators and seven pathogens. Sediments were analyzed for six indicators and seven pathogens. A control station was also established in a growing area impacted by human sources in Clear Lake, a portion of Galveston Bay.

Seasonal variations were also investigated in this study. It was found that indicators were generally lower during spring, summer and fall sampling and were much higher during the winter study especially for FC. Cryptosporidium, Vibrio cholerae 01, and Campylobacter were found in the water during the winter study. Oyster samples exhibited elevated FC levels and relatively few pathogens. Vibrio cholerae 01 was found in water only in winter and in oysters and sediments only in the fall, although it is thought to be endemic in Gulf coast waters. Indicator levels were elevated in sediment samples, especially during the spring and winter studies. E. coli, Listeria, and Vibrio cholerae 01 were also detected in sediments.

The study indicated that the elevated FC levels probably originated from non-human sources. The low levels of pathogens encountered during the study suggest a very low likelihood of transmission of disease from consumption of oysters from the Cow Trap Lake. However, the oysters from the study area exceeded NSSP market criteria (230 FC/100 grams) in three of the four study phases. The most important conclusion from the study is that no correlation of pathogen levels with FC in sediments, oysters, or waters could be demonstrated. Therefore, FC appears to hold little public health significance in the study area.

6.4 INVESTIGATION OF OTHER PUBLIC HEALTH CONCERNS

According to Sehulster (1991) of the TDH Epidemiology Division, there is no database in TDH that contains information on other pathogenic or viral diseases associated with shellfish consumption. Ms. Sehulster also noted that the TDH is not required by law to investigate or keep record of the mechanism of infection of viral diseases. In fact, the information TDH has only includes the patient's name, sex, age, race, diagnosis, method of diagnosis, city of residence of the patient, onset date, and name of the physician. For the purpose of comparing the occurrences of diseases with shellfish consumption, there are no data available.

6.5 CONCLUSIONS

The characteristics of Vibrios were investigated and documented. It was found that Vibrios are naturally occurring with water temperature and salinity probably the key factors controlling survival in aquatic environments. The relationship between occurrences of Vibrio infections and FC data is probably non-existent. While Vibrio infections can be serious and even fatal, the infection rate is quite low.